

ARBORS & FASTENERS TO AFFORD TWO FORMS OF EASY/QUICK CHANGE MOUNTING FOR ABRASIVE DISCS

Field of the Invention

[0001] This invention relates generally to abrasive finishing articles and more particularly, to a mounting structure for attaching coated abrasive finishing articles to the drive member of a power tool and to a coated abrasive finishing article with the mounting structure attached thereto..

Description of the Prior Art

[0002] The use of rotatably driven abrasive finishing articles and particularly coated abrasive finishing articles such as discs is widespread and familiar in our industrial society. Traditionally, such an abrasive disc is removably attached by way of a hub assembly including a disc support pad to a power tool. When the hub is rotated, the disc rotates with it permitting the moving disc abrasive surface to effectively finish the surface of work pieces. A variety of hub structures have been used in the prior art to secure the abrasive finishing disc to the power tool.

[0003] The earliest and very common of such structures includes a support pad having a reinforced central aperture arranged to be engaged over the threaded end of the rotary shaft of the power tool. The abrasive finishing disc is placed on the flat surface of the pad and a flanged nut is turned down onto the threaded end of the rotary shaft protruding through the disc. When the nut is tightened, the flange lays flush against the abrasive surface of the disc and clamps the disc to the support pad.

[0004] This traditional mode of attaching the abrasive finishing disc to the rotary power tool has two major disadvantages. The first of these is that in engagement of the rotating finishing disc against the work piece, a large amount of torque is imparted to the hub which tends to tighten the nut onto the threaded shaft of the power tool making it quite difficult to remove the nut in order to replace the disc after it is spent and usually involves the use of tools. In many heavy industrial applications, such abrasive discs have to be replaced quite often. As a result, when considering the number of power tools which may be in use at any given time, there is an excessive amount of downtime necessitated by such disc replacement. The second disadvantage is that the flange of the nut extends onto the abrasive

surface of the finishing disc and the worker must be quite careful to prevent the flange on the nut from engaging the work piece which in most cases would impart damage to the work piece.

[0005] In order to avoid the problems above referred to, a quick release abrasive finishing disc hub was developed and is most clearly shown in U.S. Patent Nos. 3,667,169 and 3,667,170. As is disclosed therein, an adapter is provided which is adhesively adhered to the back surface of the abrasive finishing disc. One form of such adapter includes a raised boss having a central aperture whose rim is turned inward and shaped to form a screw thread which receives the threaded end of a stud attached to the power tool or the end of the power tool shaft. Another form is a threaded stud which engages a threaded bore on the power tool shaft. This allows the user to attach or remove the abrasive disc to the power tool rather quickly. It is apparent that through the utilization of such devices, the attaching structure is disposable along with the spent disc. As above noted, the attaching structure is an adapter formed to have a screw thread and is adhesively secured to the back of the coated abrasive disc. Such structures increase the cost of the materials and labor used in the abrasive finishing process.

[0006] In view of the foregoing disadvantages of the prior art coated abrasive finishing disc mounts, it is desirable to provide a mounting device for coated abrasive finishing articles and particularly a coated abrasive finishing disc which is reusable or expendable and will provide the ability for the user to quickly and easily remove and mount abrasive finishing discs upon a portable power tool without the need for wrenches, screwdrivers, or other tools with or without the attachment of external adapters or other attachment devices directly to the abrasive finishing discs.

[0007] A typical attachment of the type above referred to for securing a coated abrasive disc having a central aperture to the power tool with a nut having a flange is shown by the patent to G. L. Bryson, U.S. Patent No. 2,699,020. An additional type of quick change structure in addition to the patents above referred to which includes an adapter secured to the abrasive discs is shown by the patent to Field, U.S. Patent No. 3,653,858.

Summary of the Invention

[0008] A disposable, reusable mounting apparatus for rotatably securing a coated abrasive finishing article to the drive member of a power tool which includes a support member and a nut adapted to extend through an aperture in the finishing article for engaging

the finishing article with the power tool which comprises an outer surface on the body of the nut which is adapted to engage an edge of the aperture through the finishing article in an interference fit and an externally threaded shank for engagement with the power tool drive member, a support pad is provided defining a centrally located aperture and a face to engage the abrasive finishing article with the support pad having a reduced thickness region adjacent and surrounding the aperture therethrough. The support member further includes a hollow externally threaded cylinder having an outwardly extending flange at one end thereof and a compression ring. The support pad is secured between the flange and the compression ring to secure the support pad upon the cylinder. The end of the cylinder having the flange defines a recess to receive a flange extending outwardly from one end of the nut so that when assembled in operational configuration, the flange on the nut is below the abrasive finishing article surface so that it cannot engage a work piece during use.

[0009] In the reusable mounting apparatus of the present invention the mounting nut includes an irregular surface on the body of the nut which is adapted to engage an edge of the aperture through the finishing article in an interference fit and when the coated abrasive finishing article is spent the nut may be popped out of the aperture in the finishing article and then reused with a new finishing article by inserting the nut through the central aperture therein.

[0010] In the disposable mounting apparatus of the present invention the nut is formed of a plastic material and further includes a retention member which engages the body of the nut immediately adjacent the finishing article in an interference fit to secure the nut to the finishing article with the combination of the nut and the finishing article being disposed of when the finishing article is spent.

Brief Description of the Drawings

[0011] Figure 1 is a cross-sectional view of a coated abrasive finishing disc assembled with the reusable mounting device of the present invention;

Figure 2 is a partially exploded view of the structure as illustrated in Figure 1;

Figure 3 is a partially exploded view of an embodiment of a disposable mounting structure in accordance with the present invention;

Figure 4 is a sideview of a disposable abrasive finishing disc with the nut of the present invention secured thereto;

Figure 5 illustrates the reusable attachment nut constructed in accordance with the principles of the present invention secured to a coated abrasive disc; and

Figure 6 illustrates in cross-section schematically one embodiment of a support pad constructed in accordance with the principles of the present invention.

Detailed Description

[0012] Referring now more particularly to Figure 1 there is illustrated schematically in cross-section, an reusable or reusable mounting device for coated abrasive discs constructed in accordance with the principles of the present invention with a coated abrasive member secured thereon. As is illustrated in Figure 1, the support member constructed in accordance with the present invention is adapted to secure an abrasive finishing article 10 in the form of a coated abrasive disc having a first surface 12 with abrasive finishing material thereon and a second uncoated surface 14 on the opposite side thereof. The disc 10 defines an aperture 16 centrally disposed therethrough. A nut 18 having a flange 20 extending outwardly from one end thereof is pushed through the aperture in such a manner that an outer surface 22 having an irregular configuration forms a substantially interference fit with the edge 24 of the aperture. As will be described more fully herein below, the irregular surface may be formed by a plurality of alternating ridges and grooves which may take any shape desired and preferably would be disposed parallel with the axis 26 of the nut. The nut includes a shank 26 which is externally threaded so as to be received within the threaded end 28 of a drive member 30 which is adapted to be affixed to a power tool (not shown) but well known to those skilled in the art. A support pad 32 is provided and has a surface 34 which engages the surface 14 of the abrasive disc 10. The support pad also defines an aperture 35 centrally disposed therethrough. The surface 34 of the support pad 32 immediately adjacent the opening 35 therethrough has a reduced thickness which is adapted to receive a second flange 36 on a cylinder 42. The support pad 32 in accordance with a preferred embodiment of the present invention is useful with smaller discs and includes a semi-rigid member 38 which may be formed of plastic having an elastomeric material 40 secured thereto with the elastomeric material 40 engaging the surface 36 of the abrasive disc 10. The support member further includes the hollow cylindrical member 42 having an externally threaded surface 44. Threadably secured upon the external surface 44 is a compression ring 46. As is shown, the support pad 32 is disposed upon an outwardly extending lip or flange 36 of the cylindrical member 42. It should be apparent to those

skilled in the art that the support pad 32 is captured between the flange 36 and the compression ring 46. It should also be noted that the flange 36 is received within the reduced thickness area of the support pad 32. The end of the cylinder adjacent the flange 36 defines a recess which is adapted to receive the flange 20 on the nut 18 so that when assembled on the mounting device, the flange 20 is below the abrasive finishing to particles on the surface 12 of the disc 10 to preclude the flange coming into contact with the work piece.

[0013] If desired, an additional backing member or disc 50 may be provided along with the support pad 32 to provide additional rigidity. Depending upon the application and the rigidity desired, the additional backup disc 50 may be constructed of metal. Under those circumstances, it may also be desirable to provide an elastomeric washer 52 which is seated between the metal disc 50 and the compression ring 46 to assist in securing the back pad and supporting discs in proper relation to provide the support desired for the abrasive finishing disc 10.

[0014] As is further shown in Figure 1, the drive member 30 includes a flange 54 which seats against a surface 56 of the cylinder 42. The cylinder 42 defines an opening 58 through which the drive member extends. The lower portion of the drive member extending through the opening 58 carries an O-ring 60 which provides frictional engagement with the opening 58. Through the frictional engagement, the support member is retained upon the drive member 30 during the time the coated abrasive disc 10 is detached for removal and replacement after it is spent. It is an important feature of the present invention that the support member is not in any way threadably attached to the drive member 30. It should be recognized that the support pad 32 along with the abrasive disc 10 is rotatable with respect to the drive member 30. As a result, the abrasive disc 10 and the support pad 32 may be rotated by hand to attach the nut 18 to the threads 28 on the drive member 30. Also, together (or simultaneously) the support pad along with the disc may be rotated in the opposite direction by hand once the disc is spent to remove the nut 18 from the threaded bore 28 of the drive member 30.

[0015] Referring now, more particularly, to Figure 2, the reusable attaching apparatus in accordance with the present invention is illustrated in partially exploded schematic fashion without the abrasive disc. The same reference numerals are utilized for the same parts as set forth in the description of Figure 1. By reference to Figure 2, the recess on the end of the cylinder adjacent the flange 36 is more clearly shown at 64. The flange 20 on the nut 18 seats within the recess 64 with the coated abrasive disc trapped between the flange 20 and the bottom of the recess 64 to thus cause the flange 20 to be positioned below the

outer surface of the abrasive disc (below the surface of the abrasive particles) so that it will not come into contact with the work piece. The irregular surface 22 constructed as a plurality of alternating ridges and grooves which cut through the edge of the aperture 35 in the abrasive disc 10 are more clearly illustrated in Figure 2. As shown, the drive member 30 is an arbor that may be inserted into the chuck or collet of a portable power tool.

[0016] It should also become more clear from the illustration shown in Figure 2 that the only threaded engagement with the drive member 30 which is interconnected to the power tool at any portion of the mounting member is between the threads 28 on the drive member 30 and the external threads on the shank 26 of the nut 18.

[0017] By referring now more particularly to Figures 3 and 4, there is illustrated that embodiment of the present invention which is intended to be disposable after the abrasive finishing article is spent during use. Figure 3 illustrates the components of the invention schematically and in exploded view. As is therein shown an abrasive finishing article 62 including abrasive particles 64 on one surface thereof has an uncoated surface 66 on the opposite side thereof. A central aperture 68 is provided through the abrasive finishing article 62. A securing nut 70 is provided. The nut 70 for this embodiment of the invention is formed preferably from an extruded rod of polyvinylchloride plastic material. The plastic material is then formed in an automatic screw machine to provide a blank which includes a flange 72 and a body 74 which extends the entire length of the nut 70 as shown in Figure 3. The body 74 has a first diameter $d1$. This blank without the threads is then placed into a feeder bowl and from there to a thread rolling machine. The thread rolling machine then forms the threads 76 on the lower portion of the body 74. A standard thread rolling machine is utilized for this purpose even though such machines traditionally are used to form threads on metal blanks. Also provided is a washer 78 which defines a second aperture 80 therethrough. The second aperture 80 has a second diameter $d2$. The second diameter $d2$ is no larger than the first diameter $d1$ and preferably may be slightly less than the diameter $d1$ so that when the assembly of the components as shown in Figure 3 is completed, as will be described more fully in conjunction with Figure 4 below, the washer 79 engages the body 74 of the nut 70 in an interference fit.

[0018] The completed structure of the disposable abrasive finishing article is shown in Figure 4. As is therein illustrated the flange 72 is completely below the surface 64 of the abrasive particles on the finishing article 62. It should be noted that the nut 70 has been inserted through the aperture 68 through the utilization of an assembly jig (not shown) which simulates the depression 64 as shown more clearly in Figure 2. Thus, the disc is

formed around the flange 72 and the washer 78 is forced into an interference fit with the body 74 of the nut 70. When the washer is forced over the body 74, it is canted or tilted to assume the slope of the surface 66 of the abrasive disc 62. Such canting causes the edge of the washer defining the aperture to cut into the body 74 to more securely fasten the nut and disc together. Such construction causes the abrasive disc 62 to more readily fit upon the support pad and structure of the type as shown in Figure 1 and Figure 2. It will be readily recognized by those skilled in the art that the disc with the disposable nut as illustrated in Figure 4 readily fits upon the support pad as shown in Figures 1 and 2.

[0019] Referring now more particularly to Figure 5, the cooperative relationship between the abrasive disc 10 and the nut 18 is better illustrated for reusable use. As is shown therein, the shank 92 of the nut 18 has formed thereon the irregular surface 22 in the form of alternating ridges and grooves which preferably are substantially parallel to the longitudinal axis of the nut 18. Preferably the nut 18 for reusable use is constructed of steel that has been machined to the desired form and then case hardened. When the nut 18 is forced into place through the central aperture formed in the abrasive disc 10, the ridges cut into the surface defining the central aperture in such a way that an interference fit is formed between the nut 18 and the central aperture in the abrasive disc 10. The interference fit then provides the ability to turn the disc 10 and at the same time, turn the nut 18 so that the threads formed internally in the bore provided therein engage the threads 28 on the drive member 30 thus, pulling the flange 20 on the nut 18 down and into the recess 64 carrying with it that portion of the abrasive disc 10 immediately surrounding the aperture through which the shank 92 has been extended thereby clamping the disc 10 in place on the support pad 32 for use. It is important to note that the flange 20 is completed below the abrasive particles on the finishing surface of the disc and therefore cannot contact the work piece. This provides the additional advantage of increasing the amount of surface available for use in finishing of the workpiece surface. It should be understood by those skilled in the art that the abrasive disc 10 may be constructed of any coated abrasive material known to those skilled in the art, for example, the disc 10 may be formed of cloth, paper, vulcanized fiber, or the like.

[0020] Referring now, more particularly, to Figure 6, the support pad 32 is shown in greater detail and the reduced diameter area is shown more clearly at 94. The plastic material of the support pad 32 as shown at 96 may be any type of plastic material desired but preferably, would be molybdenum disulfide filled nylon material.

[0021] There has thus been disclosed a mounting device for a coated abrasive finishing article in a form which may be reused indefinitely and which permits easy

attachment and detachment by hand without the use of tools for the replacement of spent abrasive discs. Alternatively, the mounting device may be in a form which is permanently secured to the disc and discarded therewith when the disc is spent. The mounting device is constructed in such a manner that the nut for attaching the abrasive disc to the support member is recessed below the surface of the abrasive disc and thus will not contact a work piece during use.